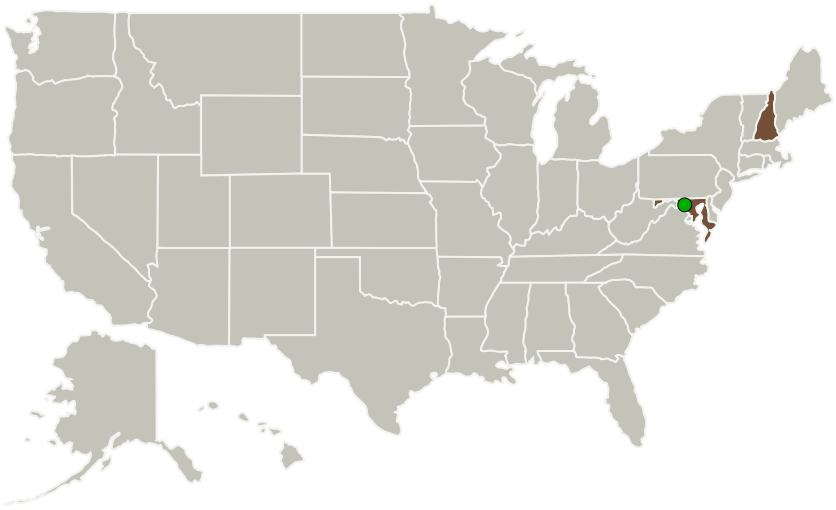
Micromachined Active Magnetic Regenerator for Low Temperature Magnetic Coolers, Phase II

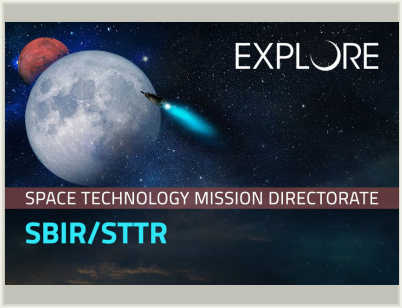
Completed Technology Project (2011 - 2015)

Project Introduction

NASA's future science missions to investigate the structure and evolution of the universe require highly efficient, very low temperature coolers for low noise detector systems. We propose to develop a highly efficient, lightweight Active Magnetic Regenerative Refrigeration (AMRR) system that can continuously provide remote/distributed cooling at temperatures in the range of 2 K with a heat sink at about 15 K. The AMRR system uses a vibration-free, reversible cryogenic circulator and Micromachined Active Magnetic Regenerators (MAMRs) to achieve a large cooling capacity and very high thermal efficiency. The MAMRs use an innovative flow channel configuration and novel micromachining technologies to achieve very high thermal and flow performance. In Phase I we proved the feasibility of our approach by demonstrating critical fabrication methods for the micromachined regenerator and its thermal and flow performance through detailed analysis. In Phase II we will build and demonstrate a full-scale micromachined regenerator for a prototype AMRR system that can provide 70 mW of cooling near 2 K. In Phase III we will demonstrate the operation of an AMRR system incorporating the MAMRs and Creare's innovative reversible cryogenic circulator.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Creare LLC	Lead Organization	Industry	Hanover, New Hampshire
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	New Hampshire

Project Transitions

June 2011: Project Start

June 2015: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137404)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Creare LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Weibo Chen

Co-Investigator:

Weibo Chen

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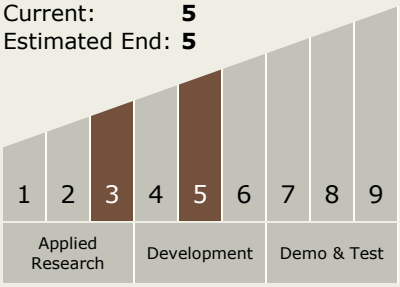
Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System